

properties and elasticity or stretchiness, all of which are desirable for the present invention. It can be solvent bonded the same as regular PVC so existing manufacturing processes can be used. Preferably the compound would contain low extractable plasticizers that resist migration from the tubing to the oils on the skin.

[0056] The invention of support tubing with the aforementioned properties can be used with any cannula that does not rely on the tubing to maintain the proper rotational angle of the nares. An unsuitable cannula is one that has the support tubing bonded along the rotational axis and/or does not bend in a preferential plane.

[0057] At least 3 types of cannula bodies are compatible with the flexible tubing of the present invention. All can be oriented properly as a result of tension or direction of the support tubing. The first is cannula that bends about the face in a defined plane such that the nares are properly oriented. Another type is a cannula that has arms bonded at points offset from the axis of rotation, effectively forming a crank that rotates the cannula when pulled by the tubing. Yet another type is a cannula body with a low center of gravity that naturally orients itself with the nares towards the top when hung from the support tubing.

[0058] In addition to the invention of the cannula and the invention of the support tubing is an invention for main supply tubing that is very manageable, drapes nicely and resists the formation of twisted loops that blocks flow in prior art tubing. The main supply tubing 6 of FIG. 1 is approximately ¼ inches diameter and between one and 35 feet long. The material is generally the same flexible material used for the support tubing.

[0059] Generally, when the length of the main supply tubing is 25 feet or more a major portion is detachable so it can be reused when a new cannula is needed. FIG. 11 illustrates typical nasal cannula assembly 10 and detachable extension tubing assembly generally denoted as 11. The extension tubing assembly consists of a length of hollow conduit 27 with connectors 7 affixed to both open ends.

[0060] Hollow conduit 27 is generally the same material as main supply tubing 6 used in the cannula assembly although it may be a harder durometer to better withstand blockage from footsteps. One end of rigid hollow tubular adaptor 28 is inserted into the end connector of cannula assembly 10 and the other end is inserted into one of the connectors 7 of extension assembly 11 so that the free end of 11 is in communication with the nares of cannula assembly 10. In most cases, the free end is connected to a gas source, most often oxygen.

Claims

[c1]

Having thus described the invention, what is claimed as new and useful and is desired to be secured by U.S. Letter Patent is:

A nasal cannula assembly designed for contact with the nasolabial area of a patient's nose and comprising:

a hollow tubular member having an opening at each end, said tubular member having a central portion of sufficient length to span the width of an average patient's nostrils and end portions extending from each end of said central portion, said central portion having a pair of spaced, hollow tubular extensions integral with and projecting therefrom said tubular extensions terminating in gas directing orifices and which hollow portion of said extensions communicate with said hollow main body portion,

said central portion lying in a first plane with longitudinal axes symmetrical about the midpoint and forming an angle in said first plane less than 180 degrees,

each said tubular extension having a longitudinal axis projecting from said central portion at an acute angle from said first plane, said gas directing orifices of said tubular extensions having a longitudinal axis lying in a second plane essentially parallel to and displaced from said first plane,

said end portions of said central portion lying in essentially the first plane with longitudinal axis of said end portion essentially collinear with longitudinal axis of corresponding symmetrical half of said central portion.

[c2]

A nasal cannula assembly as recited in claim 1, wherein said tubular extensions terminate in said gas directing orifices where thickness of material forming rim of said orifices is less than .006 inches.

[c3]

A nasal cannula assembly as recited in claim 1, wherein longitudinal axis of each said gas directing orifice angled acutely in said second plane toward second said gas directing orifice.

[c4]

A nasal cannula assembly designed for contact with the nasalabidial area of a patient's nose and comprising:

a hollow tubular member having a central portion of sufficient length to span the width of an average patient's nostrils and end portions with openings of a diameter to receive support tubing,

a pair of spaced hollow tubular extensions communicating with the interior of said tubular member and extending away from the member for directing fluid into the nostrils of the patient and/or receiving gas or pressure variations from the nostrils of the patient;

flexible support tube fitted to open end of each said end portion.

[c5]

A nasal cannula assembly as recited in claim 4 wherein said support tubes have a hardness between 40 and 75 Shore A.

[c6]

A nasal cannula assembly as recited in claim 4 wherein said support tubes have a compression set less than 45% at 23 degrees C per ASTM D-395.

[c7]

A nasal cannula assembly as recited in claim 4 wherein said support tubes have a brittle temperature less than -40 degrees C per ASTM D-746.

[c8]

A nasal cannula assembly as recited in claim 4 wherein said support tubes have a 10% tensile modulus less than 200 psi.

[c9]

A nasal cannula assembly as recited in claim 4 wherein said support tubes are manufactured from a polyvinyl chloride compound comprising at least a portion of polyvinyl chloride resin having an average molecular weight of at least about 100,000.

[c10]

A nasal cannula assembly designed for contact with the nasalabidial area of a patient's nose and comprising:

a hollow tubular member having an opening at each end, said tubular member having a central portion of sufficient length to span the width of an average patient's nostrils and end portions extending from each end of said central portion, said central portion having a pair of spaced, hollow tubular extensions integral with and projecting therefrom said tubular extensions terminating in gas directing orifices and which hollow portion of said extensions communicate with said hollow main body portion,

a pair of spaced hollow tubular extensions communicating with the interior of said tubular member and extending away from the member for directing fluid into the nostrils of the patient and/or receiving gas or pressure variations from the nostrils of the patient,

open end of each said end portion accepting support tubes,

each said support tube having an opposite open end affixed to a common coupling with hollow interior communicating with both said support tubes,

said coupling having a third opening communicating with said hollow interior and accepting open end of a flexible main supply tube.

[c11]

A nasal cannula assembly as recited in claim 10 wherein main supply tube has a hardness between 40 and 75 Shore A.

[c12]

A nasal cannula assembly as recited in claim 10 wherein main supply tube has a compression set less than 45% at 23 degrees C per ASTM D-395.

[c13]

A nasal cannula assembly as recited in claim 10 wherein main supply tube has a brittle temperature less than -40 degrees C per ASTM D-746.

[c14]

A nasal cannula assembly as recited in claim 10 wherein main supply tube has a 10% tensile modulus less than 200 psi.

[c15]